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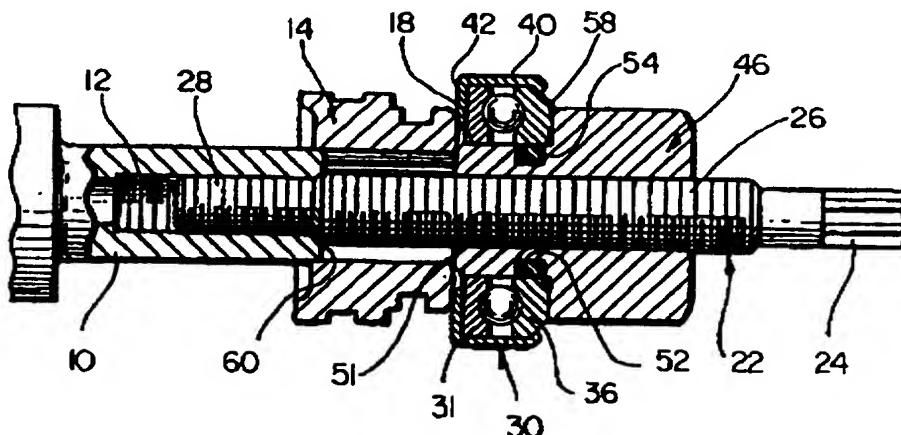
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(54) Apparatus and method for installing a hub onto a shaft

(57) An apparatus and method for installing a hub onto a shaft 10 having a cylindrical outer surface and a threaded axial bore 12. The apparatus includes a threaded screw 22 for threading into the bore, an installer nut 46 threaded onto the screw having an enlarged tool engaging end 48 and a reduced cylindrical extension (50, Fig.2) having a distal end face and an outside diameter. The apparatus further includes an annular bearing 30 removably mountable on the cylindrical extension in an installing position, having a pushing face 42 for contacting the hub and an inside diameter (32, Fig.3) slightly greater than the outside diameter of the cylindrical extension and greater than the outside diameter of the shaft, whereby the pushing face of the bearing does not contact the shaft when the hub is installed onto the shaft. When the bearing is disposed in its installing position, the end face of the cylindrical extension may be coplanar or extend beyond the plane of the pushing face.

FIG.4



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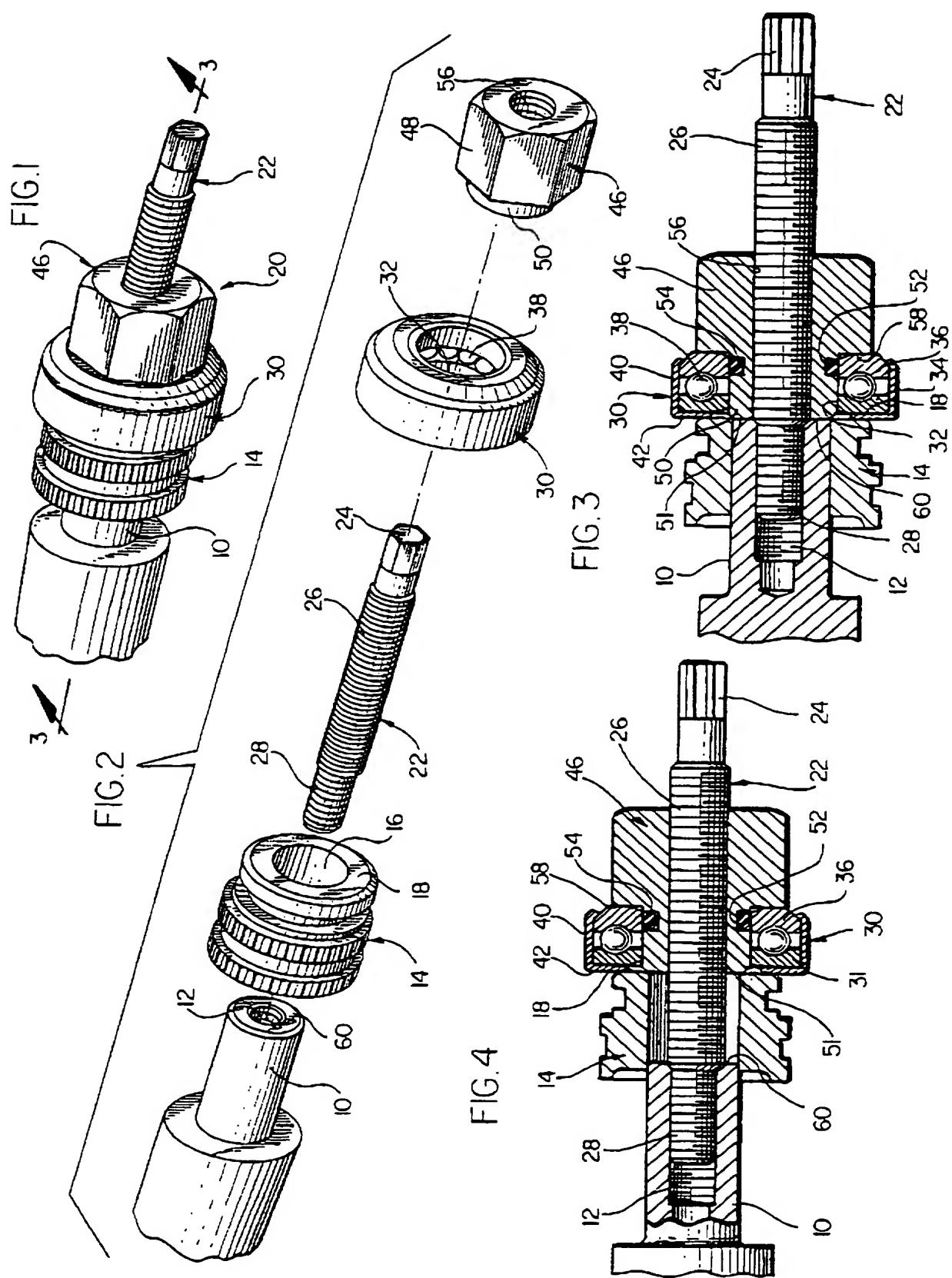
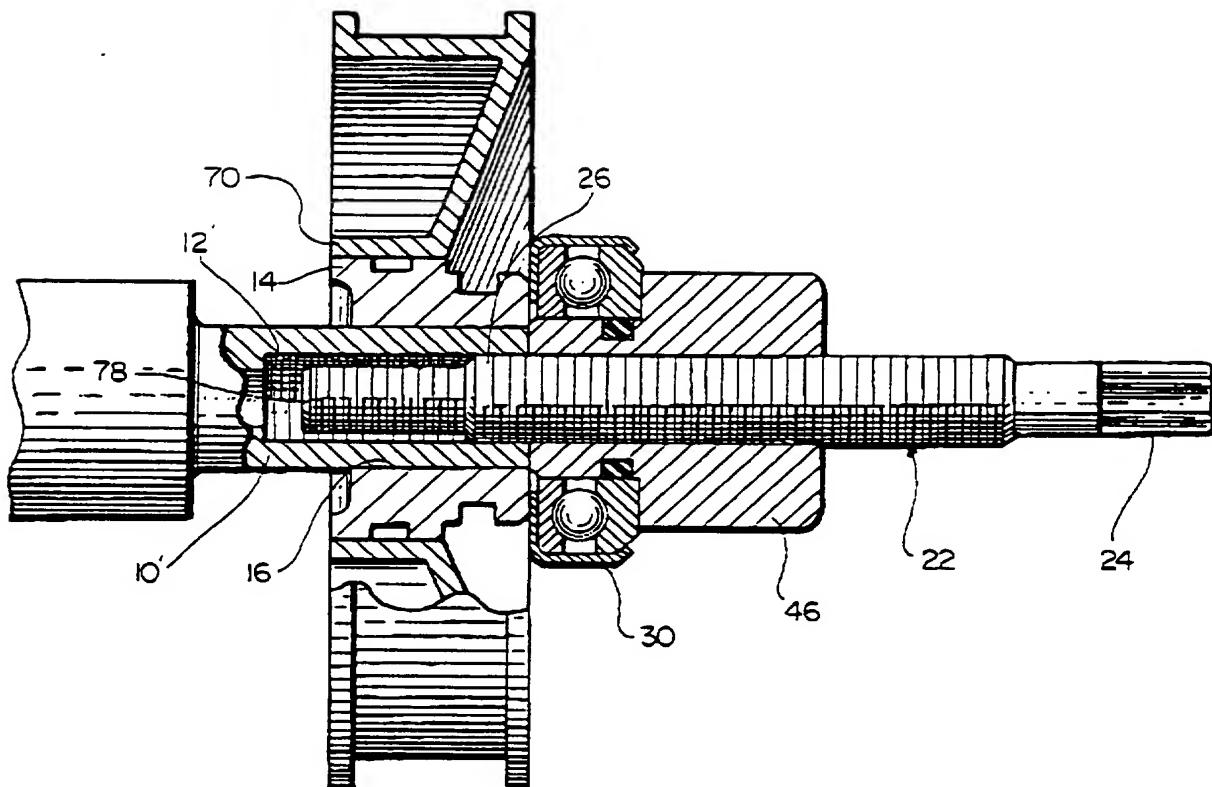
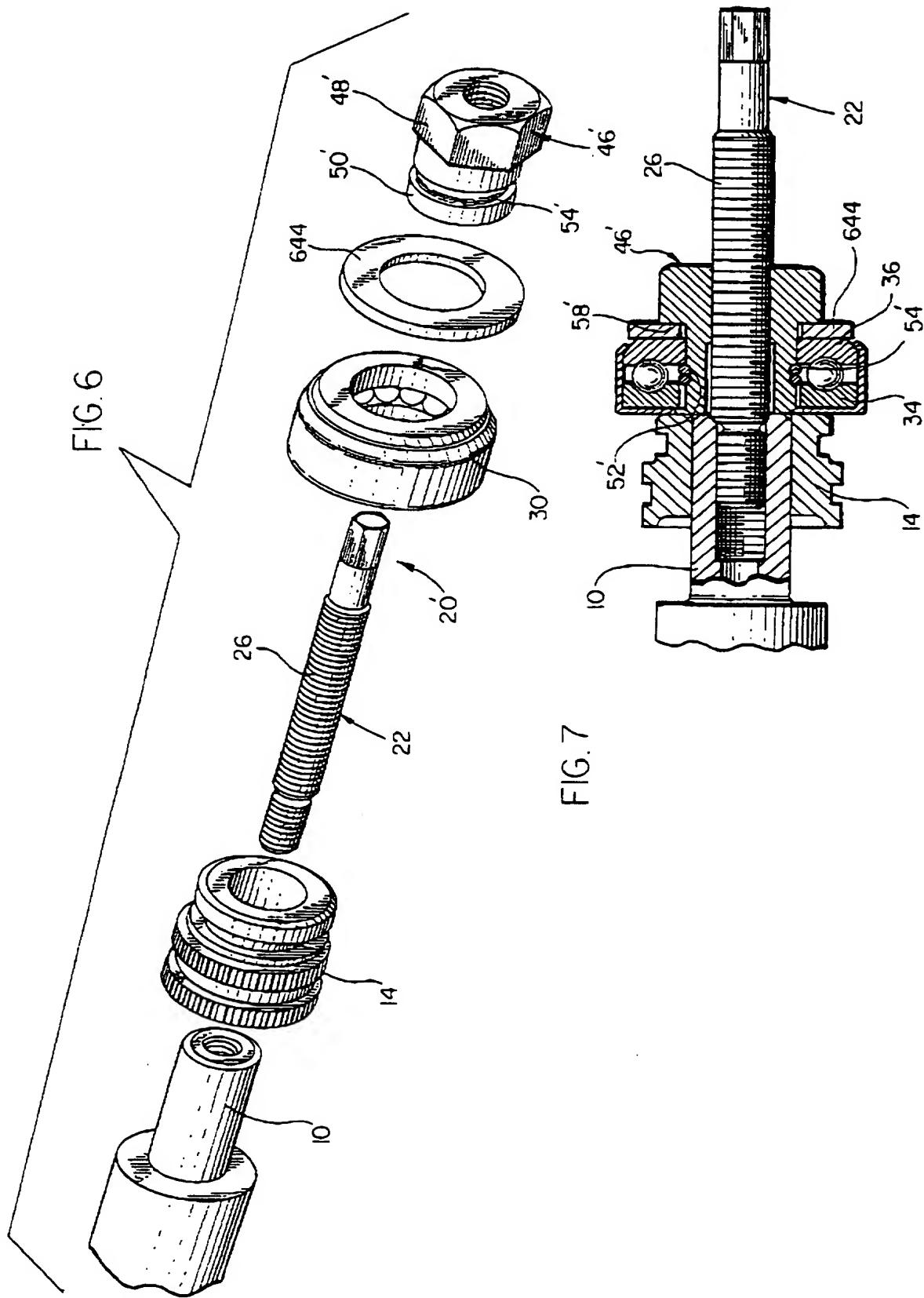


FIG. 5





HUB INSTALLING TOOLBackground of the Invention1. Field of the Invention

This invention relates to hand tools and, more particularly, to tools for installing hubs onto the ends of shafts.

2. Description of the Prior Art

The installation of mechanical components, such as hubs or pulleys, upon shafts, such as automotive power steering, water pump, alternator or other non-automotive shafts, often requires special tools for producing the force necessary to push or press fit the components onto the shaft. It is known to provide an end of such shafts with an internally threaded bore.

A tool presently available to install a hub or pulley onto a shaft includes a threaded screw for engaging the threaded bore. Threaded on the other end of the screw is a wrenching formation, such as a nut, adapted to be gripped by a wrench. A bearing is permanently attached to the nut and has a pushing face. The hub is installed onto the shaft by aligning the hub on the end of the shaft and inserting the screw through the bore of the hub and threading the screw into the bore of the shaft. Rotation of the wrenching formation then causes the pushing face of the bearing to contact a face of the hub and move it onto the shaft. The plane of the pushing face limits how far the hub can be installed on the shaft. When the pushing face of the bearing contacts the end of the shaft it can move axially no further. At this point, the end of the shaft and the face of the hub are coplanar. Since the bearing is made from a softer material than the shaft, the pushing face tends to become distorted by the harder material shaft if continued wrenching is attempted. This distortion causes hub placement accuracy to be lost. Further, repeated bearing/shaft contact causes the destruction of the bearing. Since the bearing is permanently connected to the nut, the

majority of the tool is unrepairable and, therefore, effectively destroyed.

Summary of the Invention

It is a general object of the invention to provide
5 an improved hub installing tool which avoids the disadvantages of prior tools while affording additional structural and operational advantages.

An important feature of the invention is the provision of an apparatus for installing a hub onto the end 10 of a shaft which is of a relatively simple and economical construction.

A still further feature of the invention is the provision of an apparatus of the type set forth which precisely limits the distance a hub can be installed onto a 15 shaft.

Yet another feature of the invention is the provision of an apparatus of the type set forth which is sturdy and resistant to deformation and which is easily repairable.

These and other features of the invention are attained by providing an apparatus and a method for installing a hub onto a shaft having an outside diameter and an axial threaded bore. The apparatus comprises a threaded screw for threading into the bore, an installer nut threaded onto the screw having an enlarged tool engaging end and a reduced cylindrical extension having a distal end face and an outside diameter and an annular bearing removably mountable on the cylindrical extension in an installing position, having a pushing face for contacting the hub and an inside diameter slightly greater than the outside diameter of the cylindrical extension and greater than the outside diameter of the shaft, whereby the pushing face of the bearing does not contact the shaft when the hub is installed onto the shaft.

The invention consists of certain novel features and a combination of parts hereinafter fully described,

illustrated in the accompanying drawings, and particularly pointed out in the appended claims, it being understood that various changes in the details may be made without departing from the spirit, or sacrificing any of the advantages of the present invention.

Brief Description of the Drawings

For the purpose of facilitating an understanding of the invention, there is illustrated in the accompanying drawings a preferred embodiment thereof, from an inspection of which, when considered in connection with the following description, the invention, its construction and operation, and many of its advantages should be readily understood and appreciated.

FIG. 1 is a perspective view of the hub installing tool of the present invention and a hub installed thereby onto a fragmentarily illustrated shaft;

FIG. 2 is an exploded perspective view of the hub installing tool, the hub and the shaft of FIG. 1;

FIG. 3 is a sectional view taken generally along the line 3-3 in FIG. 1;

FIG. 4 is a view similar to FIG. 3 showing the installing tool, hub and shaft at the beginning of installation of the hub onto the shaft;

FIG. 5 is an enlarged view, similar to FIG. 3, of another embodiment of the invention and showing a pulley flange in partial section to which the hub is attached;

FIG. 6 is an exploded perspective view of an alternative hub installing tool, and the hub and the shaft of FIG. 1; and

FIG. 7 is a sectional view showing the installing tool, hub and shaft of FIG. 6 after the hub has been installed onto the shaft.

Detailed Description of the Preferred Embodiments

Referring to FIGS. 1-4, there is illustrated a shaft 10, such as a power steering shaft, having an internally threaded bore 12 formed axially in one end

thereof. Referring particularly to FIGS. 1-3, a hub 14 having a central bore 16 has a tool contact face 18 and has been installed by press fitting onto the shaft 10 by a hub installing tool 20 in accordance with the present invention.

5 Though not illustrated in FIGS. 1-4, the hub 14 is typically a member of a pulley and connected to a pulley flange (see FIG. 5). The hub installing tool 20 includes a threaded screw 22 which includes a tool engaging end 24, a central threaded portion 26 and a smaller diameter threaded end portion 28 which is threadedly engageable in the bore 12 of the shaft 10.

10 The tool 20 further includes an annular bearing 30 having a central aperture 32. The bearing 30 includes a pair of disc-shaped races 34 and 36 with a plurality of balls 38 positioned therebetween and a generally cup-shaped outer shell 40 enclosing the bearing races 34 and 36. The outer shell 40 of the bearing 30 includes an annular planar pushing face 42 which, as described in greater detail below, is used to contact and push the hub 14 onto the shaft 10.

15 The tool 20 further includes an installer nut 46. The installer nut 46 includes an enlarged tool-engaging end 48 and a cylindrical extension 50. As best seen in FIGS. 3-4, the cylindrical extension 50 has a leading end face 51 and a circumferential groove 52 for receiving an O-ring 54. The installer nut 46 also includes an internally threaded bore 56 for threaded engagement with the central threaded portion 26 of the screw 22.

20 Referring to FIGS. 1, 3 and 4, the tool 20 may be assembled as follows: The O-ring 54 is placed over the cylindrical extension 50 and into the circumferential groove 52. Next, the annular bearing 30 is placed over the cylindrical extension 50 so that the race 36 contacts a radial shoulder 58 of the tool engaging end 48 of the installer nut 46. The inner diameter of the race 36 is slightly less than the outer diameter of the O-ring 54. Thus, the bearing 30 is removably maintained in place by

race 36 frictionally engaging O-ring 54. After the bearing 30 has been mounted on the installer nut 46, the nut 46 is threaded onto the central threaded portion 26 of the screw 22 to completely assemble the tool.

5 The hub 14 is installed onto the shaft 10 by the assembled hub installing tool 20 as follows: A portion of the screw 22 is passed, threaded end portion 28 first, through the central bore 16 of the hub 14. The threaded end portion 28 of the screw 22 is then threaded into the bore 12 of the shaft 10, by hand and/or by applying a wrench or other tool to the tool-engaging end 24 of the screw 22. Next, as best seen in FIG. 3, the hub 14 and its central bore 16 are positioned against an outer end 60 of the shaft 10. It should be noted that the diameter of the bore 16 of the hub 14 is slightly less than the outer diameter of the shaft 10. The hub 14 must, therefore, be forcibly pushed onto the shaft 10 and is maintained on the shaft 10 by a press fit.

20 Once the hub 14 is initially positioned, the nut 46 is rotated until the pushing face 42 of the bearing engages the hub 14. Thereupon, the installer nut 46 is further rotated by use of a wrench to force the bearing 30 to move axially and push the hub 14 onto the shaft 10. Rotation of the nut 46 continues, as seen in FIG. 3, until 25 the end face 51 of the cylindrical extension 50 contacts the end 60 of the shaft 10, this contact preventing further rotation of the nut 46.

30 In the embodiment shown in FIG. 3, the leading end face 51 of the installer nut 46 of the assembled tool 20 is substantially coplanar with the pushing face 42. This permits the tool 20 to install the hub 14 onto the shaft 10 such that, as seen in FIG. 3, the tool contact face 18 of the hub 14 is substantially coplanar with outer end 60 of the shaft 10.

35 Alternatively, the length of the cylindrical extension 50 can be varied to provide a tool capable of

installing the hub 14 at different axial positions along the shaft 10. For instance, the cylindrical extension 50 can be longer than the embodiment shown in FIGS. 1-4 so that the leading edge 51 of the extension 50 extends axially beyond the plane of the pushing face 42. Since the leading end face 51 of the cylindrical extension 50 will contact the shaft 10 sooner, the hub 14 cannot be installed as far onto the shaft 10 and its contact face 18 will be disposed outboard of the outer end 60 of the shaft 10, after it has been completely installed. Alternatively, if the length of the cylindrical extension 50 is made shorter than the embodiment shown in FIGS. 1-4, the leading end face 51 of the extension 50 will be located axially inboard of the pushing face 42. In this embodiment, the leading end face 51 will contact the shaft 10 later and, therefore, the hub 14 can be installed a further distance onto the shaft 10, such that the outer end 60 of the shaft 10 extends beyond the plane of the contact face 18 after the hub 14 has been completely installed onto the shaft 10.

As seen best in FIG. 3, the inner diameter of the bearing 30 is preferably larger than the outer diameter of the shaft 10. This prevents the shaft 10 from contacting the bearing 30 when the hub 14 is being installed. This prevents overloading or deformation of the bearing 30, which would or could occur if the bearing 30 would contact the shaft 10 to prevent the hub 14 from being installed further onto the shaft 10, since the outer shell 40 of bearing 30 is typically formed of softer material than the shaft 10. This prevention of bearing deformation allows the tool 20 to be used longer without deformation or wear and thus allows more accurate placement of the hub 14 onto the shaft 10.

Another advantage of the present invention is that the tool 20 can easily be repaired if the bearing 30 does become damaged by simply repairing or replacing the bearing 30. This advantage is achieved because the bearing 30 is releasably retained on the cylindrical extension 50 by the

O-ring 54. This type of mounting allows the bearing 30 to be quickly and easily mounted onto or removed from the extension 50 by manual pressure alone, without the use of any other equipment. This allows easy access to the bearing 30, should it need to be repaired or replaced.

It should be noted that while the tool engaging end 48 of the nut 46 and the tool engaging end 24 of the screw 22 are illustrated in the figures as being hexagonal, they may be shaped or configured in any conventional manner, including being square or slotted.

It should also be noted that since the screw 22 has two threaded portions of different diameter, the tool 20 can therefore be used on two shafts having bores of different diameter. As seen in FIG. 5, a shaft 10' having an internally threaded bore 12' with a diameter greater than the bore 12 shown in FIGS. 1-4 is illustrated. The tool 20 is used in the same way, described above, to install the hub 14 (which is shown, as described above, connected by any conventional means to a pulley flange 70) onto shaft 10' except that the threads of the central threaded portion 26 of the screw 22, rather than the threads of the smaller diameter end portion 28, engage the threads of the bore 12'.

Referring to FIGS. 6 and 7, wherein like numbers represent like elements, an alternate tool 20' is provided which is very similar to the tool 20, shown in FIGS. 1-5, except that the installer nut 46 is replaced with an alternative installer nut 46' and a washer 644. Installer nut 46' includes an enlarged tool engaging end 48' and a cylindrical extension 50' having a circumferential groove 52' for receiving a pair of O-rings 54'. The tool 20' may be assembled as follows: Annular washer 644 is placed over the cylindrical extension 50' and adjacent a radial shoulder 58' of the tool engaging end 48' of the nut 46'. Next, the O-rings 54' are placed over the cylindrical extension 50' and into the circumferential groove 52'. The annular bearing 30 is then placed over the cylindrical extension 50'

so that the race 36 of the bearing 30 contacts the washer 644. The inner diameter of the race 36 is slightly less than the outer diameter of the O-rings 54'. Thus, the bearing 30 is removably maintained in place by O-rings 54', portions of which lie within the central aperture between the races 34 and 36 of the bearing 30 and in the circumferential groove 52' of the cylindrical extension 50'. After the bearing 30 and washer 644 have been mounted on the installer nut 46', the nut 46' is threaded onto the central threaded portion 26 of the screw 22 to completely assemble the tool 20'.

The tool 20' operates in the same manner as earlier described tool 20, shown in FIGS. 1-5, except that the installer nut 46' exerts pressure directly on washer 644, rather than directly on bearing 30, when the nut 46' is rotated to push the hub 14 onto the shaft 10.

While particular embodiments of the present invention have been shown and described, it will be appreciated by those skilled in the art that changes and modifications may be made without departing from the invention in its broader aspects. Therefore, the aim in the appended claims is to cover all such changes and modifications as fall within the true spirit and scope of the invention. The matter set forth in the foregoing description and accompanying drawings is offered by way of illustration only and not as a limitation. The actual scope of the invention is intended to be defined in the following claims when viewed in their proper perspective based on the prior art.

We Claim:

1. Apparatus for installing a hub onto a shaft having an outside diameter and an axial threaded bore, comprising:

a threaded screw for threading into the bore;

5 an installer nut threaded onto the screw having an enlarged tool engaging end and a reduced cylindrical extension having a distal end face and an outside diameter; and

an annular bearing removably mountable on the

10 cylindrical extension in an installing position, having a pushing face for contacting the hub and an inside diameter slightly greater than the outside diameter of the cylindrical extension and greater than the outside diameter of the shaft, whereby the pushing face of the bearing does 15 not contact the shaft when the hub is installed onto the shaft.

2. The apparatus of claim 1, wherein the end face of the cylindrical extension is coplanar with or extends beyond the plane of the pushing face when the bearing is disposed 20 in its installing position.

3. The apparatus of claim 1, wherein the pushing face is coplanar with the end face of the cylindrical extension when the bearing is disposed in its installing position.

4. The apparatus of claim 1, wherein the bearing is 25 releasably retained on the cylindrical extension by a first O-ring.

5. The apparatus of claim 4, wherein the cylindrical extension includes a circumferential groove for receiving the first O-ring.

30 6. The apparatus of claim 5, and further comprising a second O-ring, wherein the bearing includes a pair of races and wherein portions of the first and second O-rings are disposed between the races.

7. The apparatus of claim 1, further comprising a washer disposed about the cylindrical extension between the tool engaging end and the annular bearing.

8. The apparatus of claim 1, wherein the threaded screw includes a first threaded portion having a first diameter and a second threaded portion having a second diameter less than the first diameter of the first threaded portion.

9. Apparatus for installing a hub onto a shaft having an outside diameter and an axial threaded bore, comprising:
a threaded screw for threading into the bore;
an installer nut threaded onto the screw having an
enlarged tool engaging end and a reduced cylindrical
extension having a distal end face radially dimensioned for
engagement with the shaft; and

an annular bearing removably mountable on the
cylindrical extension in an installing position, having a
pushing face for contacting the hub, wherein the end face of
the cylindrical extension is substantially coplanar with or
extends beyond the plane of the pushing face when the
bearing is in its installing position, whereby the pushing
face of the bearing does not contact the shaft when the hub
is installed onto the shaft.

10. The apparatus of claim 9, wherein the
cylindrical extension has an outside diameter, and the
bearing has an inside diameter slightly greater than the
outside diameter of the cylindrical extension and greater
than the outside diameter of the shaft.

11. The apparatus of claim 9, wherein the plane of the
pushing face is coplanar with the end face of the
cylindrical extension.

12. The apparatus of claim 9, wherein the bearing is
releasably retained on the cylindrical extension by a first
O-ring.

13. The apparatus of claim 12, wherein the cylindrical
extension includes a circumferential groove for receiving
the first O-ring.

14. The apparatus of claim 13, and further comprising
a second O-ring, wherein the bearing includes a pair of

races and wherein portions of the first and second O-rings are disposed between the races.

15. The apparatus of claim 9, further comprising a washer disposed about the cylindrical extension between the
5 tool engaging end and the annular bearing.

16. The apparatus of claim 9, wherein the threaded screw includes a first threaded portion having a first diameter and a second threaded portion having a second diameter less than the first diameter of the first threaded
10 portion.

17. A method for installing a hub having a central opening and a contact surface onto a shaft having an outside diameter and an axial threaded bore and a first end, utilizing an installing tool having a threaded screw for
15 threading into the bore, an installer nut having an enlarged tool engaging end and a reduced cylindrical extension having a distal end face, the method comprising the steps of:

20 providing an annular bearing having a pushing face for contacting the hub and an inside diameter slightly greater than the outside diameter of the cylindrical extension and greater than the outside diameter of the shaft, removably mounting the bearing on the cylindrical extension of the nut in an installing position so that the pushing face does not extend axially beyond the end face of
25 the cylindrical extension;

threading the nut onto the screw;
inserting the screw through the central opening;
threading the screw into the bore;
rotating the installer nut to cause the pushing
30 face to contact the contact surface and to push the hub onto the shaft until the end face of the cylindrical extension contacts the shaft thereby preventing further rotation of the installer nut, whereby the contact surface is substantially coplanar with the first end of the shaft after
35 the rotation is complete.

18. An apparatus for installing a hub onto a shaft, substantially as hereinbefore described with reference to, and as illustrated in, Figures 1 to 4, Figure 5, or Figures 6 and 7 of the accompanying drawings.



The
Patent
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Application No: GB 9611265.1
Claims searched: 1-18

Examiner: Hal Young
Date of search: 25 July 1996

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): B4C

Int Cl (Ed.6): B23P(19/02) ; B25B(27/02, 06)

Other:

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X	US4457061 (DOWLEY) see fig 7.	1 & 8 at least
X	US4259774 (GENERAL) see figs 1,2,4,5.	1,2,8-10, 16,17 at least

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.